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# SPRAY SCHEDULES FOR TREE FRUITS

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## Spray Schedule for Tree Fruits

P. H. WOOLEY AND W. D. MILLS

The important facts concerning the practical control of orchard diseases and insects by spraying and dusting under New York conditions are given in this bulletin. Only spray schedules based on the latest published and unpublished data of the research workers of the state experiment stations and the authors' observations of practices followed by successful fruit growers are given. It has been prepared after conferences with the members of the experiment stations at Geneva and Ithaca.

### APPLES

The most important problems are apple scab, codling moth, apple maggot, plum curculio, red-banded leaf roller, orchard mites, and aphids. Occasionally, cedar rusts are of major importance either locally or generally throughout the region. Powdery mildew has recently become a serious problem in some western New York orchards. Other diseases and insects are restricted in importance to more or less definite areas. Because of these variations in importance of the different insects and diseases with locality and year, the following schedule must be considered as a general outline of the spray program to be modified to meet the actual conditions in the orchards to be treated. In counties where the Extension Service conducts a spray-information service, valuable assistance in adapting the general recommendations to individual needs may be obtained on request.

### SPRAY OUTLINE

#### Dormant spray

*(After the buds have begun to swell but before they show green at the tip)*

The preferred time of application is in the spring when the buds have begun to swell. Weather conditions and condition of the orchard often interfere with this ideal timing, and many growers find that DNC<sup>1</sup> materials are more readily applied in the fall. It is not considered good practice to apply the DNBP<sup>2</sup> materials in the fall because injury can be severe under certain conditions.

Rosy aphid adults cease laying eggs after the temperature has dropped to 20°F. or below for a few hours. Egg-laying activity also ceases after the leaves have fallen from the trees. DNC sprays may be applied either after egg laying has ceased or after leaf fall, but for maximum safety it is best practice to wait until all or most of the leaves are off.

<sup>1</sup>DNC contains dinitro ortho cresol, sold in liquid and powder form in New York State as Elgetol, Krenite, DN Dry Mix No. 2, Dinitro Dry, Ortazol powder, and the like.

<sup>2</sup>DNBP contains dinitro secondary butyl phenol. Sold in New York State as DN-289 or Elgetol 318.

Recommended rates of DNC materials for 100 gallons of spray are: for aphid control,  $1\frac{1}{2}$  quarts or pounds; for bud moth and oystershell scale control, from 3 to 4 quarts or pounds.

Recommended rates for DNBP materials are for each 100 gallons of spray: 1 quart for aphids and 2 quarts for bud moth, San Jose scale, and scurfy scale. Oystershell scale requires from 3 to 4 quarts.

DNBP materials should not be used when any green tissue is showing. DNC materials have been used as late as up to  $\frac{1}{8}$  inch of green tissue showing without apparent harm, but this is not considered good practice and should be resorted to only in an emergency.

DNBP sprays have some effect on overwintering European red mite eggs, but not enough to depend on them for seasonal control.

### Semi-dormant sprays (silver tip, green tip, and delayed dormant)

**Silver-tip stage** (*When the blossom buds begin to swell showing silvery tips*). The first danger of apple-scab infection is on the sepals when the fruit buds are in the silver-tip stage. The development of the apple-scab fungus is closely followed and the growers are notified if scab spores are mature and if silver-tip or early green-tip infection is possible. Under such circumstances an additional early application of fungicide may be required for scab control in addition to the bordeaux mixture commonly applied in the green-tip or delayed-dormant stage. (Refer to disease control page 7.)

**Green-tip stage** (*When the blossom buds are bursting and show from  $\frac{1}{8}$  to  $\frac{1}{4}$  inch of green*), and **Delayed-dormant stage** (*When the leaves of blossom buds are out from  $\frac{1}{4}$  to  $\frac{1}{2}$  inch*). The most important disease to control through this period is apple scab. The control of such insects as European red mite, fruit-tree leaf roller, red bug, scurfy scale, and San Jose scale may also be obtained at this time with dormant superior oil.

Bordeaux mixture .....	2-4-100
"Superior" type oil .....	2 gallons
Blood albumin (actual) .....	2 ounces
Water to make .....	100 gallons

Best results have been obtained by emulsifying oil sprays in the spray tank. A suitable emulsifier is blood albumin used at the rate of 2 ounces of actual blood albumin to 100 gallons of the spray mixture. Only blood albumin that is soluble in water should be used. Those that form only a temporary suspension and settle to the bottom after being shaken vigorously in a container of water are unsatisfactory. Suitable commercial brands that contain 2 ounces of actual blood albumin in  $\frac{1}{2}$  pound of finished product are available.

Bordeaux mixture is usually added for protection against early scab infection. It is preferable to emulsify the oil with blood albumin and then to add the 2 pounds of powdered copper sulfate and 4 pounds of lime to form the bordeaux mixture rather than to emulsify the oil with the bordeaux mixture. Bordeaux-oil does not redistribute, and new growth must be protected by a fungicide before the next rain. A number of growers are now substituting ferbam for Bordeaux.

More than one spray may be required during this period for apple scab control. The above formula containing oil and bordeaux or oil and ferbam mixture should, however, be used only once. It has been shown that European red mite



Figure 1. Proper stage to apply green-tip spray



Figure 2. Proper stage to apply delayed-dormant spray



Figure 3. Pre-blossom, earliest stage when only one spray is applied



Figure 4. Pre-blossom, ideal stage to spray if weather permits



Figure 5. Proper stage to apply petal-fall spray

control is effective at any time during the green-tip or delayed-dormant period and it is therefore merely a convenience to use the bordeaux-oil formula.

For Rome, Jonathan, Cortland, Baldwin, and Monroe varieties, sulfur sprays are preferable to organic fungicides; captan, ferbam, glyodin, and cyprex are all ineffective for mildew control. The only organic fungicide so far demonstrated to be effective in mildew control is dinitro capryl phenylcrotonate sold as Karathane and Mildex. One pound per 100 gallons is needed for mildew control in pre-blossom sprays. This fungicide does not control scab and the addition of a scab fungicide is needed.

If a San Jose scale problem exists, the 2 gallons of oil in the bordeaux-oil formula will be enough. If scurfy scale or fruit-tree leaf roller are a problem, 3 gallons of oil are needed.

If a DN spray was omitted or could not be applied for aphid control, BHC may be used at the rate of 2 pounds of a 10 per cent gamma isomer powder or the equivalent in other strengths or lindane at 1 pound of the 25 per cent powder in the bordeaux-oil formula. Best results are obtained at the full delayed-dormant stage; but to prevent injury from the bordeaux-oil formula, spraying should be completed before the leaves roll back and expose the blossom buds. This spray is not so efficient as a dormant DN spray for aphids and is ineffective against bud moth.

Combined aphid and bud-moth control may be had with malathion. It is used at the rate of 2 pounds of the 25 per cent wettable powder. Parathion may be used for this purpose in extreme emergency at the rate of 1 pound of 15 per cent wettable powder, but the reduction in scab control at this time does not warrant its use. If a ferbam-oil mixture is used rather than a bordeaux-oil mixture, TEPP may be used to control aphids alone. None of these materials controls oyster-shell scale.

### Pre-blossom sprays

The pre-blossom spray or sprays, applied between the delayed-dormant spray and the bloom, are timed primarily for scab control. The points to be considered in timing the applications are: the occurrence of rain periods, the amount of new growth, and the stage of development of the scab fungus. In some seasons, two or more pre-blossom applications may be required for effective scab control, especially on extremely susceptible varieties such as McIntosh.

Dusting or spraying with elemental sulfurs during rain may be a valuable aid in scab control. Both are effective if properly applied. The paste sulfurs are especially valuable for sprays during rain, but the dry wettable sulfurs may also be used. The addition of 1 pound of hydrated lime increases the effectiveness of both forms. An oil type of sticker increases the deposit of sulfur during a rain, but the flotation paste sulfurs give excellent control at from 10 to 12 pounds in 100 gallons of spray without a sticker. Sulfur dusts are effective also during rain, but usually an application must be repeated for protection through the next rain. The finest divided dusts are most effective and the addition of wetters or stickers to the dusts has not been shown to increase effectiveness.

The phenyl mercury compounds and dichlorone (Phygon) may also be used in rain or after rain. Both materials give some degree of after-rain control but should not be applied on wet foliage during bloom or during or preceding very high temperatures. In past years, the mercury sprays in bloom have apparently

caused no injury to foliage, fruit set, or to bees. In 1953, however, serious reduction in set followed bloom sprays of mercury.

The combination sprays of half strength mercury with half strength of glyodin, ferbam, captan, or sulfur reduce but do not eliminate the injury by mercury.

Post-bloom sprays of mercury preceding or during hot weather have caused leaf injury and drop, and in some instances fruit drop as well. Mercury should not be used after the petal-fall spray. Dichlone in a seasonal schedule has caused a serious reduction in bloom and fruit set the following year. Its use should be limited to occasional pre-cover sprays at low dosages.

Ferbam is safe on apple foliage, but has caused considerable enlargement of fruit lenticels and some russetting. Ferbam is inferior to sulfur paste as a protectant against leaf scab but at 1½ pounds per hundred gallons equals 5 pounds of dry wettable sulfur in control of fruit scab.

On red and Golden Delicious, captan (Captan 50W and Orthocide) has usually given higher finish than any other fungicide for the past three years.

If insects, such as **fruit tree leaf rollers**, **green fruitworms**, **tarnished plant bugs**, **tent caterpillars**, and **cankerworms**, present a serious threat to the foliage or buds, 2 pounds of 50 per cent wettable DDT powder may be included in the pink spray. Generally, unless the threat is serious, it is advisable to postpone the use of DDT until petal-fall spray to reduce possible danger to pollinating insects. *Lead arsenate, guthion, or dieldrin should not be used in this spray because they*

#### DISEASE CONTROL

Disease	Time	Materials (Numbers refer to paragraph descriptions)	Amount per 100 gallons
Apple scab	Dormant to delayed dormant	DNC (Elgetol)	¼ gallon (600 gallons per acre on ground)
Most effective in severely scabbed, isolated orchards. Not a substitute for the regular tree sprays. DNBP appears slightly less effective than the DNC compounds.			
Apple scab	From silver-tip or green-tip stage through the primary scab infection period	1. Glyodin	1 quart
		or	
		Glyoxide	10 ounces
		or	
		2. Captan	2 pounds (1½ pounds in a protective schedule)
		or	
		3. Ferbam	1½ pounds
		or	
		4. Sulfur at manufacturer's directions	
		or	
		5. Cyprex	¼ pound
		or	
		6. Other programs: Mercury compounds (manufacturer's directions), dichlone (Phygon) (½ pound), Niacide A (1½ pounds), Phybam-S (4 pounds), or Thylate (2 pounds).	



are poisonous to pollinating insects. If an insecticide is to be used in this spray, honeybees must be removed from the neighborhood.

Substitute programs for **European red mite** control using ovex, Kelthane, mitox, tedion, and genite EM923 are discussed under the heading "Preventive Programs." page 20.

1. **Glyodin (Crag 341)** has been shown to be an effective protectant against scab at 1 quart per 100 gallons during primary scab and 1 pint to 1½ pints in later sprays. It should not be used on apples at dosages of more than 1 quart per 100 gallons. Glyodin tends to increase arsenical injury on susceptible varieties such as Rhode Island Greening and Cortland and to a much less degree on McIntosh. In 1955 and 1957, the arsenical injury to leaves was very late in appearing and was not serious where fresh hydrated lime was used at the same rate as the lead arsenate. During the past several seasons either ferbam, ½ pound, or Nu-Iron, ½ pound, added to the glyodin-lead arsenate mixture was more effective than lime in preventing arsenical injury.

Glyodin has controlled **sooty blotch** in experimental tests.

Glyodin and glyoxide are compatible with mercury compounds and can be used with them for the control of scab. Glyodin and glyoxide are compatible with sulfur and Karathane and can be used in combination for combined control of scab and **powdery mildew** (see mildew recommendations page 11).

The remarks made above for glyodin also apply to glyoxide.

2. **Captan (Orthocide 406 and Captan 50W)** still appears to be one of the most effective fungicides for apple scab control. In addition to protective action captan also gives some after-infection control. Present evidence indicates it cannot be relied upon for control when applied more than 18-24 hours after the beginning of rain at an average temperature of 50°F. Captan has consistently given the highest finish on Golden Delicious of any fungicide tested. Captan has caused leaf spotting, yellowing and dropping of leaves when used at full strength early in the season on Red Delicious. Sulfur sprays immediately preceding captan appear to increase injury. Do not use sulfur in combination with captan on Red Delicious, Baldwin, or King. Bordeaux-oil sprays were shown to greatly increase captan injury to Red Delicious. Captan has been used successfully on a weekly spray schedule in New York. However, the spray interval should be shortened if excess washing of the spray residue occurs or if there is rapid growth and expansion of new tissue during a critical period for spore discharge. Under these conditions captan cannot be relied upon for control. Captan is compatible with mercury and can be used in the ½ and ½ mixtures to increase "back-kick" or eradication properties. Captan can also be used in combination with sulfur or Karathane for mildew control except on varieties mentioned above.

3. **Ferbam** is safe on apple foliage but has caused considerable enlargement of fruit lenticels in certain seasons on Golden Delicious which is subject to severe russetting. Ferbam is less effective than paste sulfurs as a protectant against leaf scab at 1½ pounds per 100 gallons but equals 5 pounds on actual sulfur in the control of fruit scab. It is useful alone or in combination with other fungicides for the control of rust diseases and sooty blotch. Ferbam at ½ pound per 100 gallons gives adequate correction of arsenical injury for up to 3 pounds of lead in 100 gallons of spray. Ferbam can be used at half strength with half strength mercury as an eradicant scab spray. Ferbam is also compatible with sulfur and Karathane in mildew sprays.



4. **Sulfur compounds.** Magnetic 70 paste is recommended at the rate of 7 pounds per 100 gallons of spray. Rate should be increased to 8-9 pounds if used in the rain. Magnetic 70 is somewhat more expensive than other sulfurs but is easier to handle and is preferred by many growers. **Dry wettable sulfurs** are used at a rate of 5 pounds per 100 gallons (7-8 pounds plus oil-type sticker in rain) in early season sprays in a protective program. Critical tests indicate that most of the dry wettable sulfurs are slightly inferior to the paste sulfurs in scab control. **Liquid lime-sulfur** at 2 gallons per 100 gallons is an excellent protectant against apple scab and may give after rain control of scab for 50 hours at optimal scab temperatures and for longer periods at low temperatures. In a seasonal program lime-sulfur causes too much fruit and foliage injury. Formation of blossom buds and fruit set are reduced over a period of years. Injury most likely to appear when lime-sulfur is applied to wet foliage during or preceding periods of high temperatures or during bloom. **Sulfur dusts** are valuable supplements to sulfur sprays in early season applications. Dusting during the rain before infection occurs is the most effective method. The finer divided dusts have shown to be more adherent and more effective.

With the exception of lime-sulfur, as noted above, the sulfurs do not have any scab eradication action. The sulfur compounds are very effective materials for scab control when properly timed in a protective program. They may be used up to and including bloom without reduction in fruit set. In post bloom sprays the sulfur compounds may cause fruit russetting and reduction in yields. All sulfur compounds have been reported as increasing captan injury on susceptible varieties. Sulfur sprays control powdery mildew in pre-bloom and bloom sprays.

5. **Cyprex** (coined name "dodine") at  $\frac{1}{2}$  pound (65% WP) per 100 gallons has been shown to be an excellent scab fungicide. Cyprex has some local systemic action in controlling apple scab. Present evidence indicates it will eradicate scab infection for 20-28 hours after the beginning of a rain. Cyprex may cause fruit injury if applied at freezing or near freezing temperatures, particularly when accompanied by slow drying conditions. Lime should not be added to Cyprex or injury of fruit and foliage will be increased. Cyprex does not correct arsenical injury and ferbam should be added for arsenical correction. Cyprex will russet Golden Delicious. Cyprex is compatible with captan, ferbam, sulfur, Karathane, mercury compounds, glyodin and the standard insecticides. If desired, Cyprex could be used with mercury compounds to increase interval for scab eradication. Cyprex can also be used with sulfur or Karathane for mildew control. Cyprex does not control the rust diseases of apples. Cyprex can cause severe foliage injury on peaches, plums, and some varieties of pears.

#### 6. Other Scab Control Programs:

**Mercury compounds** may be used alone at full strength to give after-rain control for the longest period after infection. The effective period varies with the temperature, but at any temperature the effective period frequently causes spray injury when applied on wet foliage, during bloom, and during or preceding high temperatures. Foliage injury, fruit russetting and reduction in blossom formation and in fruit set may follow. The use of half-strength mercury with half-strength sulfur, or one of the organic fungicides has appeared to reduce the amount of injury and also reduce the period of after-rain effectiveness. Post-bloom sprays of mercury during or preceding high temperatures have caused severe leaf injury, leaf drop, and in some instances severe fruit drop. Straight

precover schedules of mercury have caused considerable foliage injury, reduced fruit set, and fruit russetting. Mercury should be limited to use in pre-bloom after-infection sprays when the effectiveness of the preventive spray program is in doubt. When the spray can be applied soon after the rain, one of the half-strength mercury combinations is preferable to the full strength.

**Dichlone** (Phygon) should be limited to pre-bloom applications at low rates. At  $\frac{1}{2}$  pound per 100 gallons in a seasonal schedule Phygon has caused a serious reduction in bloom and fruit set the following year. Apparently this fungicide is less safe under Hudson Valley conditions, where it caused serious russetting on several varieties in 1952 and 1957, than in northern New England and in the Champlain Valley. Russetting following Phygon has also occurred in western New York when used after bloom in repeated applications. Where Phygon is used in after-rain scab control, a mixture of  $\frac{1}{2}$  strength Phygon with  $\frac{1}{2}$  strength ferbam is suggested. Use of Phygon should be avoided during low temperatures since it appears to greatly increase fruit russet, particularly when used with sulfur.

**Niacide A** performs about the same as ferbam for controlling apple scab and cedar rusts. Fruit finish of McIntosh, Cortland, Jonathan, and Delicious was good. Results in western New York have been satisfactory in scab control and fruit finish on McIntosh and Cortland where protection only was involved. Reports from some other states have been less favorable and it appears this material should still be recommended on a trial basis. Niacide M appears a little safer than Niacide A so far as fruit finish is concerned.

**Phybam-S** at the rate of 4 pounds contains  $\frac{1}{4}$  lb. Phygon,  $\frac{1}{2}$  lb. ferbam, and 3 lbs. sulfur. Used through petal fall, Phybam-S has given good control of apple scab, apple rust, and powdery mildew.

**Thylate** looks promising in the Hudson Valley as a substitute for ferbam on varieties subject to fruit russet when both scab and rust diseases must be controlled. It has also been used in combination with captan with good results. Thylate was superior to ferbam for scab control and finish in 1958 in the Hudson Valley. In western New York, the combination of thylate-lead arsenate caused light to moderate arsenical foliage injury on McIntosh and Cortland. In western New York where cedar rust has not been a problem, Thylate seems to have no particular advantage.

Apple scab	Summer applications	1. Sulfur dust	
		2. Ferbam	
			1-1 $\frac{1}{2}$ lbs. (Delicious, 1 lb.) (McIntosh, 1 $\frac{1}{2}$ lbs.)
		3. Glyodin	2 pints through primary
		or	1 $\frac{1}{2}$ pints summer.
		Glyoxide	8 ounces. (summer)
		4. Captan	1 $\frac{1}{2}$ lbs.
		5. coarse dry wettable sulfur (325 mesh)	5 lbs. (7-8 lbs. plus sticker in rain).
		6. Cyprex (pending label approval)	$\frac{3}{4}$ lb.

Normally  $\frac{1}{2}$ - $\frac{3}{4}$  of the standard rate is recommended during the summer applications if scab is controlled. Fungicides should be used at full strength if primary scab was not satisfactorily controlled.

Fine sulfurs cause too much injury for summer use. Even the 325-mesh sulfur will cause injury if applied during or just before periods of high temperatures.

<b>Apple rust</b>	<b>Green tip through curculio, including bloom</b>	Ferbam alone	(Delicious) 1 pound (McIntosh) 1 1/2 pounds
		or Ferbam	1/4 pound plus 1/4 strength other fungicide
<b>Quince rust</b>	<b>Pink and bloom spray</b>	Same as for apple rust (Combined rust and scab control)	

<b>Powdery mildew</b>	Choice of programs listed below.		
	1. Std. scab fungicide	Half strength	Green tip through petal fall.
	plus	plus	
	Sulfur	3 pounds actual	
	Std. scab fungicide	Full strength	Post bloom through mid-June.
	plus	plus	
	Karathane	1/4 pound	Green tip through petal fall.
2. Sulfur		5 pounds actual	Post bloom through mid-June.
		2-4 pounds actual	Green tip through petal fall.
3. Karathane		1 pound	Post bloom through mid-June.
		1/4 pound	

New York experiments in 1955 and 1956 indicated that in the regular schedule of pre-bloom and bloom sprays, 1/4 pound and 1 pound of Karathane were inferior to 5 pounds of sulfur in mildew control. A schedule of sulfur sprays before and during bloom, with Karathane at 1/2 pound after bloom, was as effective as sulfur in all sprays in Western New York tests in 1957. This combined schedule avoids possible sulfur injury in sprays after bloom and reduces the cost of a seasonal schedule of Karathane in all sprays to mid-June. A good scab fungicide should be added to Karathane.

Mildew is most serious on Monroe, Jonathan, Rome, Cortland, and Baldwin trees receiving organic fungicides. Where mildew exists it is suggested that sulfur be used at the rate of 3 pounds in pre-bloom sprays with half strength of one of the standard scab fungicides followed by Karathane at 1/2 pound plus a scab fungicide in post-bloom sprays for effective and economical mildew control. Where mildew is not a serious problem the addition of 1 pound of sulfur or 1/4 pound of Karathane in all sprays has prevented mildew build-up. Two ounces of B1956 spreader-sticker in late sprays will increase effectiveness of materials but if used early in the season may result in poor scab control. Glyodin and Cyprex increase spreading and wetting of sulfur.

<b>Fire blight</b>	<b>In bloom</b> (see next page)	Streptomycin	100 ppm
		or	
		Bordeaux mixture	2-6-100
		or	
		Copper-lime dust	20-80

Recent studies indicate that Bordeaux mixture is almost ineffective with temperatures in the 60's while streptomycin gives substantial control in this range. At higher temperatures Bordeaux mixture gave substantial control of fire blight but was still less effective than streptomycin. It is suggested, there-

fore, that streptomycin be used in all sprays for fire blight if the problem is severe, and that Bordeaux be used if the problem is less severe but important enough to warrant some control measures. If a severe problem exists, streptomycin may be used for a year or two until the general level of infection in the orchard is reduced, then in subsequent years Bordeaux be used unless conditions extremely favorable for infection occur. These conditions are defined as temperatures of 65°F or higher with rainfall or high humidity.

The following suggestions are made with respect to timing the spray applications. As soon as the first blossoms open weather conditions should be watched carefully. If maximum temperatures of 65°F with precipitation or high humidity are expected a spray application should be made. If such conditions prevail or are expected again when  $\frac{3}{4}$  or more of the blossoms are open a second application should be made. If the first application is made after substantial blossoms are open the second application may be delayed correspondingly. Under very severe conditions a third application might be made in late bloom after the petals start to drop.

Serious infection has occurred when heavy dashing rains occurred soon after the spray was applied. If  $\frac{1}{2}$  inch or more of rainfall occurs within 24 hours after a spray application another application should be made after the rain is over.

When fire blight is of moderate severity the cost of control might be reduced by using the two materials on the following basis. Use Bordeaux mixture under conditions of very high temperatures, but apply streptomycin when temperatures are expected to reach 65°F but not much higher. Better results with streptomycin can be expected when the spray is made under poor-drying conditions (evening or days with high humidity). Prolonged drying apparently allows better penetration and more absorption of the streptomycin.

Sprays of streptomycin after bloom, when terminal blight appears, have not proved effective under New York conditions to justify the high cost. Unless very thorough pruning out of blight cankers is practiced, severe terminal blight may follow from the oozing cankers despite good control of blossom blight by bloom sprays. Blossom blight may also result from heavy ooze dripping from nearby cankers. Effective control of blossom blight by spraying cannot be expected on susceptible varieties unless holdover blight is reduced to a minimum by pruning during the winter.

<b>Brooks fruit spot</b>	<b>Summer sprays</b>	Ferbam	1 pound
		<b>or</b> Elemental sulfur plus lead arsenate	5 pounds actual sulfur
Controlled by sulfur plus lead arsenate. Ferbam is preferable when lead arsenate is not used.			
<b>Sooty blotch</b>	<b>Summer sprays</b>	Ferbam	1 pound
		<b>or</b> Glyodin	1 ½ pints
<b>Fly speck</b>	<b>Summer sprays</b>	Elemental sulfur	5 pounds actual sulfur

**Special-bloom spray or sprays**

Bloom sprays and dusts may be of great value in orchards where much **powdery mildew** is a problem (page 11).

Ferbam has been shown in Hudson Valley experiments to be much more efficient than sulfur in the control of **cedar rusts**. Where the rusts are serious in the Hudson Valley,  $\frac{3}{4}$  pound of this organic compound, with 3 pounds of elemental sulfur in 100 gallons of spray, is suggested for the pre-bloom spray, in a bloom spray, and in the petal-fall and curculio sprays.

In orchards that received the pre-blossom spray some time in advance of the opening of the blossoms or where the pre-blossom spray was omitted, or in seasons when the bloom period is unusually long and rainy, bloom applications of elemental sulfur may be valuable aids in scab control. Yield, however, may be reduced by these bloom applications, and their use is justified only when the amount of bloom and pollinating conditions are adequate and a disease problem exists. *Insecticides should not be included in any bloom application.*

### **Petal-fall and succeeding sprays**

In the following pages a basis for choice of materials to combat summer activity of insects is presented. As foliage becomes heavier following the petal-fall stage, closer attention is needed to adjust spray machinery of the air-blast type, particularly where the spray mixture is concentrated, to meet the varied requirements of pests that differ markedly in their habits of attack.

**Petal-fall spray** (*When the last of the blossom petals are falling*). Before the petal-fall spray is applied, one should remove any honeybees from the orchard and place them at least a mile away.

For protection against **apple scab**, an organic fungicide is applied at manufacturer's directions or elemental sulfur at the rate of 5 pounds (actual sulfur) in 100 gallons of spray mixture. The normal practice is to combine fungicide and insecticide in the same tank. In some recent years, even 325-mesh sulfur has given considerable spray injury when applied during or preceding periods of intense heat. The organic fungicides at manufacturer's recommendation seem preferable to the sulfur except in orchards where **powdery mildew** is a problem.

This spray is very important for the control of many insects and should not be neglected, particularly with respect to the activity of the **plum curculio**. In response to high temperatures after the developing fruit has attained a size of  $\frac{1}{4}$  inch, curculio adults begin making egg-laying cuts which may result in crescent-shaped scars as well as round feeding punctures. The injury takes place after maximum temperatures reach 75°F. for two or more days in succession.

The basic insecticide in the petal-fall spray is selected as a result of observations on the intensity of plum curculio attack in past years. Following this choice, the control of other insects present in a susceptible stage of development at petal fall should be considered, taking into account the insects already controlled in the dormant, green-tip, or delayed-dormant stages. (Refer to plum curculio control on apples, page 15.)

Provisions should be made to control the **European apple sawfly** in orchards on Long Island and in Westchester, Rockland, Orange, Ulster, and Dutchess Counties. It has been proved that BHC at the rate of 2 pounds of 10 per cent gamma isomer content, or equivalent strength of the gamma isomer in other formulations, in 100 gallons of dilute spray offers the most effective control when used at the petal-fall stage. Unfortunately, this material gives poor control of the

plum curculio, and a more effective one must be added to the BHC in most orchards in this area. Parathion is almost as effective on the sawfly as is BHC, and gives excellent curculio control but offers other problems in the Hudson Valley area that is predominantly planted to the McIntosh variety. Dieldrin at petal fall controls a light infestation of sawfly, but insufficient evidence is available to be certain of its effectiveness under severe outbreak conditions.

Parathion is not recommended on the McIntosh variety and its relatives. In the past parathion has been recommended in the petal-fall and one or two subsequent sprays for the control of curculio, **European red mite**, **early codling moth**, **European sawfly** and the **red-banded leaf roller** on these varieties, with activated charcoal as a safener. In view of continuous experimental evidence of yield reduction, increase in scab infection and injury it appears wiser not to attempt its use on these varieties. There is ample evidence to indicate that it can be used without difficulty on Rome, Baldwin, Rhode Island Greening and Northern Spy. Although experimental evidence is not available, probably other "hard" varieties would not suffer from use of either of these materials.

**Pre-cover spray** (*From 7 to 12 days after petal fall*). This spray in previous issues of this Bulletin was termed either the *special scab spray* or the *10-day spray*. For protection against apple scab, organic fungicide at manufacturers' directions or 325-mesh sulfur at the rate of 5 pounds in 100 gallons of spray mixture may be used alone or included with the selected insecticides. In western New York orchards in many seasons, a special spray, applied about two weeks after the petal-fall spray, may be required for control of **apple scab**.

The **plum curculio** is still active at the time of this spray. By the proper selection of materials, the pre-cover spray can also control the **red-banded leafroller**. Special attention should be paid to applying this spray thoroughly to the undersides of the leaves, for this is where the larvae feed exclusively. To prevent damage from succeeding broods, it is important that a first-brood control measure be used in all orchards where it is intended to use DDT in the cover sprays.

Since 1956 research workers in Western New York have noticed an increase in the number of orchards having populations of **red-banded leaf rollers** showing resistance to DDD. At present our only means of combating this development is the use of phosphates (parathion, guthion, phosdrin, or diazinon) or a combination of DDD plus one of the phosphates in the schedule. In most cases two sprays, petal fall and pre-cover, will be necessary to control first brood resistant populations. Two sprays applied in late July or early August will also be required to control second brood activity.

In view of the increased cost of the program for controlling resistant leaf rollers, it is suggested that all possibilities be explored for improved timing of the spray and adequate coverage to affect control. It is well recognized that control of the first brood reduced the activity potential of subsequent broods. Materials recommended for the control of normal and resistant populations of red-banded leaf rollers are discussed on pages 17 and 18.

**Cover sprays.** The purpose of the cover sprays is to control **codling moth**, **apple maggot**, **red-banded leaf roller**, and **apple scab**. Mites and the **green apple aphid** may also become problems.

It is usual to include a fungicide in all summer sprays for **scab** control. In the cover sprays, if scab control is good, captan and ferbam may be reduced to 1 pound, and glyodin to 1 to 1½ pints, in 100 gallons of spray.

A summer-spray program of sulfur and lead arsenate usually controls **Brooks fruit-spot**. In the Hudson Valley, 1 pound of ferbam may be substituted for the sulfur when lead arsenate is not used. Occasionally, one or more special scab sprays of fungicide alone rather than combined with the insecticide are applied during this period if frequent scab rains prevail.

The first cover spray is timed just before the onset of **codling-moth** larval activity on the fruit. Where it is intended to follow a lead arsenate schedule for the control of codling moth, it should be recognized that the first spray for codling-moth control is the petal-fall spray, and lead arsenate should be applied at that time before the calyx cup closes. Since lead arsenate has little contact action on the larvae, this is necessary to prevent entry at this point. With most of the other materials in the codling-moth control selection list (page 18), this is not nearly so important since varying degrees of moth kill, egg kill, and contact kill of larvae are obtained.

In eastern New York, it normally requires 6 codling-moth cover sprays to span the period of codling-moth activity. In western New York, 5 are usually applied. This number varies, however, with the material selected as indicated in table 1.

Table 1. Normal interval in days between cover sprays with various materials

Material	Codling Moth (Days)	Apple Maggot (Days)
DDT.....	10	10
DDD.....	10	10
Methoxychlor.....	10	10
Lead Arsenate.....	12 to 14	12 to 14
Parathion.....	12 to 14	3 to 5
Malathion.....	12 to 14	2 to 4
Diazinon.....	10 to 14	10
Guthion.....	10 to 14	10
Sevin.....	10 to 14	10

## DUSTING FOR APPLE SCAB

For scab control, experimental work shows sulfur dusts are most effective when applied during rain before infection occurs. The finer divided dusts are more adherent than the coarser forms. For this reason, the grower should insist on a dusting sulfur equal in fineness to the dry wettable sulfur even if the cost is higher.

## PLUM CURCULIO CONTROL

### Hudson Valley Area

From three to four sprays are needed, beginning at petal-fall stage. The sprays may be timed from 8 to 12 days apart, depending on the frequency of scab rains where the fungicides are involved, or of high temperature periods. Parathion should be used in a 7- to 10-day schedule. The sprays that cover the period of curculio attack are normally the petal-fall spray, an intermediate spray called the *first precover spray* (this has been known as the *curculio* or *10-day spray*), and the first cover spray. In some years, when cool weather following the petal-fall stage prolongs the period of curculio activity, a second pre-cover spray may be needed.



## Western New York and Champlain Valley

From two to three sprays are needed beginning at the petal-fall stage. The same timing for materials is used as in the Hudson Valley area. In most years two sprays are enough—one at petal-fall and a second spray from 7 to 12 days after petal-fall that might be termed the *first precover spray* or *precure spray*. Curculio activity usually has ceased by the time of the first cover spray in this area. Occasionally a prolonged cool spell makes a third spray for curculio necessary.

### Materials

All amounts given are in terms of amount per 100 gallons of dilute spray.

**Dieldrin (50 per cent wettable powder)** at  $\frac{1}{2}$  pound, gives excellent control. Fruit or foliage injury has never been reported. Dieldrin controls also **European apple sawfly**, **tarnished plant bug**, and **tent caterpillars**. *Cautions or suggestions:* Build-up of fruit tree leaf roller should be watched for, also bud moth or other minor pests if oil or DN has been omitted.

**Guthion (25 per cent wettable powder)** at 1 pound has given excellent control of plum curculio. Guthion at 1 pound will also control **mites**, **codling moth**, **red-banded leaf roller**, **fruit tree leaf roller**, and **aphids**. *Cautions and suggestions:* Respirator must be used and all human safety precautions followed.

**Methoxychlor (50 per cent wettable powder)** at 3 pounds gives excellent control. No injury has ever been observed in this area. Methoxychlor controls also **fruit tree leaf roller**, **codling moth**, **tarnished plant bug**, **green fruit worms**, and **cankerworms**. *Cautions or suggestions:* A strong European red mite control program is needed.

**Parathion (15 per cent wettable powder)** at 2 pounds gives excellent control. Severe injury and reduction in yield may occur to McIntosh and its relatives and it is not recommended for use on these varieties. Parathion controls also **codling moth**, **European apple sawfly**, **European red mite**, **fruit tree leaf roller**, **red-banded leaf roller**, **green fruit worms**, **cankerworms**, **tarnished plant bug**, and **scale insects**. *Cautions and suggestions:* Respirator and all human safety measures are required. Parathion may russet Golden Delicious but is safe to use on Rome, Baldwin, Greening, Spy and possibly other varieties of this nature.

**Endrin (75 per cent wettable powder)** at  $\frac{1}{3}$  pound will control **plum curculio** and **red-banded leaf roller** when used in the petal fall and pre-cover sprays.

**Lead arsenate** at 3 pounds gives poor curculio control (good enough in very light infestations such as are sometimes encountered in the western New York and Champlain Valley areas in isolated orchards). Controls also **fruit tree leaf roller**, **green fruit worms**, **cankerworms** and, in light infestations, **codling moth**. *Cautions and Suggestions:* Program is of value where parasites and predators have been reduced in numbers by all of these other schedules.

**Sevin (50 per cent wettable powder)** at 2 pounds has given control of curculio in light infestations and is suggested for use on a *trial basis*. At the 2 pound level, sevin will also control **European apple sawfly**, **fruit tree leaf roller**, and **codling moth**. First brood control of **red-banded leaf roller** is only fair. *Cautions and suggestions:* Applications of sevin in early sprays (petal fall and pre-cover) has caused severe leaf spotting on McIntosh. Therefore, sevin is not recommended before first cover on this variety.

## RED-BANDED LEAF ROLLER CONTROL

The selection of an insecticide control program will depend on whether the populations are resistant to DDD, the variety of apples being sprayed, and the end use of the apples, such as, processing apples or apples being produced for fresh fruit. The control of mites, plum curculio, codling moth, and apple maggot should be considered when selecting a red-banded leaf roller control program.

### First Brood Control

#### Materials

All amounts are given in terms of amount per 100 gallons of dilute spray.

**DDD (50 per cent wettable powder)** at 2 pounds applied in the precover spray gives excellent control of first brood. In some seasons two sprays may be required. Two pounds applied in late July or early August, timed at approximately mid-hatch of second brood egg masses will provide adequate protection against second brood red-banded, codling moth, and apple maggot.

**DDD (50 per cent wettable powder)** at 2 pounds plus malathion (25 per cent wettable powder) at 2 pounds applied in petal fall and pre-cover has controlled DDD resistant populations. Some added benefits in mite and aphid control.

**Parathion (15 per cent wettable powder)** at 2 pounds in the petal fall spray followed by a combination of parathion at 2 pounds plus DDD at 2 pounds in the pre-cover spray. If properly applied in two sprays parathions will control first brood. The addition of DDD in the pre-cover spray will provide longer residual activity. This program will also control **plum curculio, mites, aphids,** and other early season insects. *Cautions and Suggestions:* See remarks under Plum Curculio Control on page 16.

**Phosdrin (25 per cent emulsifiable concentrate)** used at  $\frac{1}{2}$  pint in the petal fall and pre-cover has controlled resistant populations. Phosdrin can be used as an emergency treatment against larger first brood larvae at a rate of 1 pint. *Cautions and Suggestions:* Phosdrin is highly toxic to humans. A special respirator should be used and all exposed portions of the body should be covered. Your county agent can supply you with the names of respirators recommended when spraying with phosdrin.

**Guthion (25 per cent wettable powder)** at 1 pound applied in petal fall and pre-cover has given good control of first brood. **Plum curculio, mites, aphids,** and **fruit tree leaf roller** are also controlled in these two sprays. DDD resistant populations can also be controlled with this program. Guthion has controlled second brood when used on a seasonal schedule. *Cautions and Suggestions:* Respirator must be used and all safety precautions followed.

**Endrin (75 per cent wettable powder)** at  $\frac{1}{3}$  pound applied in petal fall and pre-cover has given good control of resistant populations. Endrin will also control **plum curculio**. Applications should go on at petal fall for maximum control of both insects. *Cautions and Suggestions:* Endrin is toxic to humans and a respirator must be used. Other safety precautions must also be followed.

**Sevin (50 per cent wettable powder)** at 2 pounds has controlled first brood satisfactorily. Sevin is not recommended for use on McIntosh because of possible injury. It is recommended on a trial basis on other varieties. Possibility for use in early season for combined control of **plum curculio, fruit tree leaf roller,**

tarnished plant bug, European apple sawfly, and aphids. *Cautions and Suggestions:* See statement under Plum Curculio Control.

### Second Brood Control

In order to obtain commercial control of DDD resistant populations of red-banded leaf roller two insecticide applications are required for the second brood. The first spray will normally be applied in late July and the second spray in early August. The following programs, based on the ultimate market for the fruit or the variety of fruit, are suggested.

#### Processed Fruit

Two sprays required with either program.

**Program 1:** Lead arsenate, 3 pounds, plus Malathion, 2 pounds (25% WP), or Parathion, 2 pounds (15% WP), or Phosdrin, ½ pint (25% EC).

**Program 2:** DDD, 2 pounds (50% WP), plus Malathion, 2 pounds (25% WP), or Parathion, 2 pounds (15% WP), or Phosdrin, ½ pint (25% EC).

#### Fresh Fruit

##### First Spray (late July)

Lead arsenate, 3 pounds

plus

One of phosphates listed above

##### Second Spray (early August)

DDD, 2 pounds (50% WP)

plus

One of phosphates listed above

DDD plus one of the phosphates could be used in both sprays for fresh fruit and not exceed the legal residue tolerances.

#### McIntosh and phosphate susceptible varieties

Any of the programs listed under Processed Fruit or Fresh Fruit so long as parathion is not included in the spray mixture. Parathion is not recommended for use on McIntosh and related varieties.

### CODLING-MOTH CONTROL

DDT (50 per cent wettable powder) 2 pounds, gives excellent codling-moth control, also controls apple maggot and white apple leafhopper. Bud moth control is possible with proper timing. *Cautions and suggestions:* Usually there is a build-up of mites and red-banded leaf roller populations when used.

Guthion (25 per cent wettable powder) at 1 pound has given excellent control of codling moth when used in a seasonal program. Also controls apple maggot, aphids, and suppresses mites. Guthion will control red-banded leaf roller if used in a seasonal schedule. *Cautions and suggestions:* Use respirator and follow all safety precautions.

Sevin (50 per cent wettable powder) at 1 pound has equaled DDT in the control of codling moth. Used at the 1 pound rate for codling moth, sevin will also give summer control of green aphids. May have to increase dosage to 2 pounds for effective maggot control.

Lead arsenate, 2 pounds, added to the 1 pound of sevin should give adequate protection against apple maggot.

**DDT (50 per cent wettable powder)** 2 pounds plus **lead arsenate** 2 pounds. Also controls **apple maggot** more effectively than any other material or mixture. *Cautions and suggestions:* Introduced primarily for use during the month of July at 12- to 14-day intervals for combined codling-moth and apple-maggot control.

**DDT (50 per cent wettable powder)** 2 pounds, plus **parathion** (15 per cent wettable powder) 1 pound. Excellent codling-moth control. This combination is suggested for use where codling-moth is not being controlled by DDT. Possible injury to McIntosh and phosphate susceptible varieties. Controls also **European red mite**, **green apple aphid**, and **two-spotted mite**. *Cautions and suggestions:* Respirator and other human safety equipment must be used. This mixture was introduced to reduce visible and actual residues of DDT and is commonly used at the 1½ pound rate of DDT. However, apple-maggot control fails unless there is a very short interval between sprays. At the 2 pound rate of DDT maggot control is possible at 8- to 10-day intervals.

**DDT (50 per cent wettable powder)** 1 pound plus **Malathion** (25 per cent wettable powder) 2 pounds. Excellent control of codling moth. Of value where it is certain that a population of codling moths has become resistant to DDT alone as in a few orchards in western New York. Also controls **apple maggot**, **European red mite**, **two-spotted mite**, **bud moth**, **white apple leafhopper**. *Cautions and suggestions:* Strains of European red mite may become resistant after several years of use.

**Parathion (15 per cent wettable powder)** 1½ pounds. Excellent codling-moth control. The fruit of McIntosh and its relatives may be injured without the addition of ¾ pound of spray-grade activated charcoal to each pound of parathion used per 100 gallons of dilute spray. The use of both charcoal and parathion are discouraged after the second cover spray on these susceptible sorts because of either poor finish or danger of injury. Parathion controls also **orchard mites** and **green apple aphid**. *Cautions or suggestions:* Not suggested as a full program but may be used in one or two cover sprays where other insect or mite control is desired, provided DDT or lead arsenate is added for protection against apple maggot or there is a 3- to 5-day interval between sprays.

**Methoxychlor (50 per cent wettable powder)** 2 or 3 pounds; 2 pounds gives fair codling-moth control and 3 pounds would be considered good. Used as a **combined codling-moth and apple-maggot control** in late cover sprays. Not suggested for a full codling-moth program in commercial orchards.

**Lead arsenate** 3 pounds. Poor to fair codling-moth control. Good enough under the light infestations found in more isolated orchards of western New York and in the Champlain Valley. Controls also **apple maggot**. For use in orchards where codling-moth activity is relatively light, because there are not many days when dawn or dusk temperatures are 60°F. when it is favorable for codling moth to lay eggs. With a straight lead-arsenate schedule, predators and parasites are encouraged to help keep down the populations of mites and red-banded leaf rollers as well as other insects.

**Diazinon (25 per cent wettable powder)** at 2 pounds has equalled DDT in controlling **codling moth**. Diazinon at this rate will also control **apple maggot**. *Cautions and suggestions:* Possibility for use on **DDT-resistant codling moth**. See remarks under Mite and Aphid Control (page 21). Has caused russetting on Rhode Islands Greening, Baldwin and Golden Delicious.

**Diazinon** (25 per cent wettable powder) at 1 pound plus **DDT** (50 per cent wettable powder) at 1 pound is also a possibility for use on resistant codling moths. *Cautions and suggestions:* This combination should control apple mag-gots. See remarks under Mite and Aphid Control (page 21).

### MITE AND APHID CONTROL

Investigations conducted during the past few years indicate two basic types of programs for mite control. They are classified as preventive programs and eradivative programs. A preventive program is defined as any program that, through a single spray or multiple sprays of a miticide, reduces mite populations to low levels and prevents any build-up through the season. On the other hand, an eradivative program is designed to control mites after they have increased in numbers sufficient to cause extensive damage to the crop. A preventive program has been shown to be superior to the eradivative program.

#### Preventive Programs

All amounts are given in terms of 100 gallons of dilute spray.

**Superior type petroleum oil**, 3 gallons of 100 second viscosity rating in dormant or 2 gallons from green-tip to delayed-dormant spray or at manufacturer's directions where a prepared oil is used. This material has long been considered the standard preventive program for **European red mites**. Controls also **San Jose Scale**, **lecanium scale**, and **red bug**. At 3 gallons in the delayed-dormant spray or 4 gallons in the dormant spray it controls **fruit tree leaf roller** and **scurfy scale**. *Cautions or suggestions:* Later applications of a mite-control material may be needed in some orchards in seasons favorable to mite development.

**Superior type petroleum oil**, 2 gallons of 70 second viscosity rating, applied in the green-tip or delayed-dormant stage. A lighter oil than the standard 90 second viscosity superior oil commonly used. As effective in controlling **European red mite** as the 90 second viscosity oil, but is less injurious to the trees. May be used with more green tissue showing.

**Genite EM 923**, 1½ pints of the 50 per cent liquid or 1½ pounds of the 50 per cent wettable powder. One application in the pink stage. Shows promise as a substitute for oil against **European red mite**. Not effective against other insects.

**Mitox**, 1 pound of the 40 per cent wettable powder. One application in the pink stage. Has given excellent control of phosphate-resistant **red mites**.

**Tedion**, 1 pound of the 25 per cent wettable powder. One application in the pink stage. Has given excellent control of **red mites**.

**Ovex**, (50 per cent wettable powder) ¼ pound in the pink spray, ½ pound in the pre-cover, second cover, and fourth cover sprays. Introduced primarily as a program to reduce the need for watching mite populations closely. Does not control anything but mites. *Cautions and suggestions:* Gives partial control of **two-spotted mite**.

**Kelthane**, (18.5 per cent wettable powder) applied at a rate of ½ pound in the pink, pre-cover, second cover, and fourth cover sprays. Both **red** and **two-spotted mites** have been controlled in experimental blocks. Recommended on a trial basis because of limited grower experience. Not effective against other insects.

## Eradicative Programs

All of the following programs can be applied to control **European red mite** or the **two- or four-spotted mites** as follows: (1) at pink and at petal-fall or (2) in any two applications from 7 to 10 days apart beginning from petal-fall on. It is suggested that if earlier sprays have been omitted for European red mite, that the two sprays of any of the following materials be applied no later than pre-cover and 7 to 10 days later. Those materials that are effective against aphids may be applied as needed.

**Kelthane**, 1½ pounds of 18.5 per cent wettable powder.

Excellent against both **red mite** and **two-spotted mite**.

Kelthane will control phosphate resistant **red mites**.

**Parathion**, 1 pound of the 15 per cent wettable powder. Controls also many other pests, particularly useful for **bud moth** and **aphids**. *Cautions and suggestions:* Injurious to McIntosh and its relatives, useful on other varieties. Respirator and other human safety precautions required. Resistant European red mites have been known to build up when used over a period of years.

**Trithion**, 1 pound of the 25 per cent wettable powder. One application in the third or fourth cover spray. Will give some control of **codling moth**, **apple maggot** and **aphids**. *Cautions and suggestions:* Respirator and other human safety measures required.

**Malathion**, 2 pounds of the 25 per cent wettable powder. Controls also **aphids**, **bud moth**, and a number of other pests. *Cautions and suggestions:* Safe on McIntosh and its relatives as well as on other varieties. Although a phosphate, malathion is safe to use without extra precautions other than normally expected with most spray chemicals.

**Demeton**, from ¼ to ¾ pint of the 22 per cent liquid; ½ pint would be the normal recommendation, although ¾ pint may be needed in some instances to extend the systemic action of this systemic chemical. Also controls **aphids**. *Cautions and suggestions:* Respirator and other human safety measures required. Gives more extended protection than most other chemicals because of its ability to enter the plant sap.

**TEPP**, ½ pint of the 20 per cent product or ¼ pint of the 40 per cent product. Controls also **aphids** but of little value against other pests. *Cautions or suggestions:* Requires use of respirator and other human safety precautions. Most parathion-resistant mites appear to be resistant to TEPP.

**Diazinon**, 1 pound of the 25 per cent wettable powder, has been effective in controlling **European red mite** and **aphids** in experimental tests in 1955, 1956, and 1957. It will also control **two-spotted mites**.

**DN-289 or Elgetol 318**, 2 quarts. Offers variable control of European red-mite eggs when applied as a dormant spray, but egg kill is not in sufficient numbers to be considered as a program by itself. The partial kill obtained, however, may allow the omission of the pink spray in the ovex schedule. Inspection of the trees will determine whether the pink spray is necessary for red mite control.

## RESIDUES

In all spraying practices the provisions of Public Law 518, an Amendment to the Food, Drug and Cosmetic Act, must be strictly followed. Legal tolerances guaranteeing the safety of fresh fruit have been set up. Fruit is expected to have residues below these tolerances at harvest time or be subject to seizure by federal or state enforcement agencies. All of the information needed to stay within such tolerances is presented on the labels of the chemicals used for pest-control purposes.

*Table 2. Legal tolerances and number of days before harvest materials should be applied to insure residues will be below the tolerance\**

Material	Tolerance	Days before harvest
	<i>ppm</i>	<i>Days</i>
DDT.....	7	30
DDD.....	7	30
Methoxychlor.....	14	7
Lead (2 pounds per 100 gallons).....	7	30
Lead (3 pounds per 100 gallons).....	7	45
Arsenic (2 pounds per 100 gallons).....	3.5	30
Arsenic (3 pounds per 100 gallons).....	3.5	45
Parathion.....	1	21
Tedion.....	0	**
Malathion.....	8	3
Peaches:	8	7
Dieldrin.....	0.25	35
Peaches:	0.1	45
Endrin.....	0	**
Demeton (Systox).....	0.75	21
Ovex.....	3	45
TEPP.....	0	3
Diazinon.....	0.75	14
Sevin.....	10	7
Guthion.....	2	15
Phosdrin.....	0.5	1
Genite EM 923.....	0	**
Mitox.....	3	**
Kelthane.....	5	7
Peaches:	10	14
Trithion.....	0.8	30
Captan.....	25	†
Ferbam.....	7	†
Glyodin.....	5	†
Organic mercury.....	0	†
Zineb.....	7	†
Ziram.....	7	†
Cyprex.....	0	**

\*Petroleum oil, ryania, rotenone, pyrethrum, sulfur, and copper are exempt from a tolerance and may be used at any time consistent with good agricultural practices.

†Number of days to harvest are not specified for fungicides with the exceptions of mercury compounds which should not be applied after petal fall.

\*\*No residue at harvest if used according to recommendations.



## TYPICAL SPRAY SCHEDULE—APPLE INSECT CONTROL

A typical spray schedule for control of insects on McIntosh as an example in New York State might appear as follows:

Time	Eastern New York	Western New York
Dormant	DN or substitute	DN or substitute
Delayed dormant	Oil or substitute	Oil or substitute
Petal-fall	Dieldrin plus BHC (BHC for sawfly)	Dieldrin or lead arsenate
Pre-cover	Dieldrin plus DDD	Dieldrin or lead arsenate plus DDD
First cover	Dieldrin plus DDT	DDT
*Second cover	DDT	DDT
Third cover	DDT plus lead arsenate	DDT plus lead arsenate
Fourth cover	DDT plus lead arsenate	DDD
Fifth cover	DDD	DDD
Sixth cover	DDT	

\*Mite or aphid control material as needed through the remainder of the sprays.

## PEAR

A practical spray schedule for pears in New York must be built around the control measures required for **pear psylla**, for this pest is by far the most serious of any to the pear crop. The **pear tarnished plant bug**, **pear midge**, **stink bug**, **fruit-tree leaf roller**, **green fruit-worms**, **sinuate pear borer**, **rose leaf beetle**, and **quince curculio** cause damage in some orchards. The most important disease of pears is **fire blight**, but **pear scab**, **sooty blotch**, **leaf spot**, and **Fabraea leaf-blight** and **fruit spot** are important in some orchards. The spray schedule includes sprays for all these. All growers do not have to apply all of the sprays. The grower should, therefore, select from the schedule those sprays needed to protect his particular orchard.

### SPRAY OUTLINE

The choice of control measures for **pear psylla** depends upon the availability of materials and upon the experience of the individual grower as to other insect problems in his orchard. A basic schedule consists of a "late dormant" application followed by one or more of the later sprays if necessary.

### Spring Applications

#### Dormant spray

*(When the buds are not yet showing green)*

Superior dormant oil .....	3 gallons
Blood albumin (actual) .....	2 ounces
Water to make .....	100 gallons

This treatment is made where **pear leaf blister mite** is troublesome. The oil is effective against adult psylla but most growers now prefer to use one of the late dormant treatments where psylla alone is the problem.

**Pear scab** has caused serious losses in Western New York orchards in some years. A thorough ground spray of DNC paste at the rate of 2 quarts per 100 gallons of water applied at 400 to 600 gallons per acre has helped reduce the disease potential. The ground spray is best applied in the dormant period but may be applied through the green-tip stage. For best results a fungicide should also be included in the pre-blossom spray.

### Late dormant spray

(From the stage when blossom bud scales are loosened until green leaf tips are showing)

Elgetol, Krenite, or Dinitrosol (DNC materials), 1 gallon in 100 gallons of spray, applied in the green-tip stage controls both **pear psylla** and **sooty blotch**. If sooty blotch is not a problem, either 2 quarts or 2 pounds of a DNC material may be used in this spray to kill pear-psylla eggs. The new DNBP materials (DN-289 or Elgetol-318) may be used against psylla eggs at a concentration of 2 quarts to 100 gallons of spray mixture.

Parathion at 1 to 1½ pounds, guthion at 1 pound, or malathion at 2 pounds in 100 gallons may be used to kill pear psylla eggs at this time in place of the DN materials. Parathion, guthion, and malathion appear to be less injurious to the trees and also allow somewhat more leeway in timing the treatment than do the DN materials. These materials are probably not effective against sooty blotch.

### Pre-blossom spray

(When the blossom buds begin to separate in the cluster)

A pre-blossom application is necessary only in orchards where **pear scab** or **pear midge** is a problem. For **scab** control the following fungicides are recommended.

Elemental sulfur at manufacturer's directions

or

Captan ..... 2 pounds

or

Ferbam ..... 1½ pounds

or

Glyodin ..... 1 quart

or

Bordeaux mixture ..... 2-10-100

plus

Water to make ..... 100 gallons

The most effective control for **pear midge** is 2 pounds of DDT powder to 100 gallons of spray applied when the blossom buds are swollen but before the sepals have begun to separate and again 7 days later. At this time the midge flies are usually "swarming" on the trunks and will readily take flight if disturbed.

### Special bloom sprays for Fire Blight

(same as for Apple, see page 11)

The spray applications are supplementary to such measures as cutting out or chemical treatment of cankers, pruning out blighted branches and suckers, and breaking off blighted fruit spurs.

### Petal-fall spray

(When the last of the petals are falling)

One of fungicides listed under pre-blossom spray.

plus

Parathion ..... 1 to 2 pounds

or

Guthion ..... 1 pound

The parathion or guthion is effective against pear psylla as well as false tarnished plant bug, fruit tree leaf roller, green fruit worms, and plum curculio. DDT, 2 pounds, or lead arsenate and lime, 3 pounds each, may also be used for control of the pests mentioned if psylla is not a problem. In orchards where pear psylla is the only problem, this petal-fall spray may be omitted. Lead arsenate, DDT, or parathion may be used with the Bordeaux mixture. Insecticides should not be used on open blossoms.

### First-nymph spray

*(About a week to 10 days after the petals have fallen)*

The materials and suggestions are the same as those given under the petal fall spray.

This spray is made especially for pear psylla, but also furnishes protection against plum curculio and pear scab. Any one of the formulas listed under early summer sprays may be used where pear psylla alone is a problem.

### Special spray for rose leaf beetle, quince curculio, and sinuate pear borer

*(About June 10; usually necessary only in eastern New York orchards wherever these pests may be a problem)*

Lead arsenate .....	3 pounds
Hydrated lime .....	3 pounds
Spreader .....	½ pound
Water to make .....	100 gallons

If sinuate pear borer is a problem, the lead arsenate and lime are increased to 5 pounds each, or 2 pounds of DDT is added to the spray mixture.

## Summer Sprays

*(When psylla becomes threatening)*

### Early summer sprays

*(In July when most of the second-brood psylla eggs have hatched)*

At this time any one of three mixtures may be used for pear psylla:

Parathion .....	1 pound
or	
Guthion .....	1 pound
or	
Malathion .....	2 pounds
plus	
Water to make .....	100 gallons

A fungicide may be added to the above formulas where pear scab is a problem.

Excellent control of sooty blotch and of *Fabraea* leaf and fruit spot may be obtained by the use of 1 pound of ferric dimethyldithiocarbamate (ferbam) to 100 gallons in the summer sprays.

### Late summer spray

*(Early in August if psylla becomes abundant and threatens to smut the fruit or if the second-brood codling moth is a problem)*

In areas of New York where **codling moth** is troublesome, late injury may be prevented by using a mixture of 1 pound of 50 per cent DDT and 1 pound of parathion or 2 pounds of DDT where psylla is not a problem. Where codling moth is not a problem, the DDT is omitted. If DDT is omitted any of the formulas given under early summer sprays may be repeated at this time if necessary for psylla. The spray usually is applied during the first two weeks of August.

**Residues.** Tolerances and residue requirements are identical to those listed for apples (page 22.)

**Phosphate Injury.** A replicated test was conducted in Niagara County in 1956 to determine if the phosphates, parathion and malathion, were responsible for the browning of pear leaves noticed in many orchards over the past few years. In this particular orchard, injury had been severe in the 1954 and 1955 seasons. No damage occurred in 1956 in any of the plots. Ferbam, glyodin and captan were also included in the test. These results appear to indicate that heat is the primary cause of this injury. The severity of the injury may be increased by the phosphates and several other spray materials.

## CHERRY

Under New York conditions, cherries are sprayed principally to control **leaf spot**, **brown rot**, and **fruit flies**. In some locations the **plum curculio** may require attention. **Black cherry aphid** is confined as a pest mostly to sweet cherries.

### SPRAY OUTLINE

#### For Sour Cherries

#### Pre-blossom spray for sour cherries

*(Just before the blossoms open)*

Elemental sulfur (actual sulfur) .....	5 pounds
or	
Captan .....	2 pounds
plus	
Water to make .....	100 gallons

This spray is applied for the control of **brown-rot blossom-blight**. It is important in most seasons on English Morello, and may be needed in some years on Montmorency cherries.

### Petal-fall spray for sour cherries

(When the last of the petals are falling)

Low-soluble copper at manufacturers' directions plus 1 pound of lime for each  $\frac{1}{4}$  pound of metallic copper in the mixture plus 1 pint of oil type sticker.

	or	
Elemental-sulfur paste .....	10 pounds	
Oil type of sticker .....	1 pint	
	or	
Elemental sulfur .....	5 pounds	
	or	
Captan .....	2 pounds	
	plus	
*Lead arsenate .....	2½ pounds	
Hydrated spray lime.....	2½ pounds	
	or	
Guthion.....	1 pound	
	or	
Parathion .....	2 pounds	
	or	
Methoxychlor .....	3 pounds	
	plus	
Water to make .....	100 gallons	

\*Use 1 pound on English Morello to reduce the danger of arsenical injury ("dry-stem").

This spray is effective against **leaf spot**, **brown rot**, and **curculio**.

Fixed coppers have given good control of leaf spot; but stem-end injury to fruit may occur. The fixed copper should be used at a rate giving  $\frac{3}{4}$  pound actual copper per 100 gallons. Glyodin at 1½ pints gave excellent leaf spot control and caused no injury. Captan, glyodin, or ferbam used in shuck fall and first fruit fly sprays will avoid stem-end injury to fruit caused by fixed coppers but will not prevent arsenical dry stem. Lime should be used in all cherry sprays in orchards receiving lead arsenate in fruit fly sprays. Dithane D-14 (1 quart) plus ferric sulfate (5 ounces) has appeared satisfactory in cherry leaf spot control in preliminary work in New York and is considered promising in some other states. Ferbam at  $\frac{1}{2}$  lb. per 100 gallons or Nu-Iron at  $\frac{1}{2}$  lb. per 100 gallons have provided more satisfactory arsenical injury correction than lime at 2 lbs. per 100 gallons. A mixture of cyprex ( $\frac{1}{4}$  lb.) plus captan (1 lb.) has given good leaf spot control and also corrected arsenical injury. Cyprex at  $\frac{1}{2}$  lb. caused fruit injury in Pennsylvania in 1959.

Actidione might be considered in applications of 1 ppm in the pre-harvest and at 1 or 2 ppm in the post-harvest sprays. The particular advantage of actidione lies in its after-infection control and the eradication of leaf spot lesions. Reduction in fruit crop may occur with applications at excessive rates made at the time the cherries are about  $\frac{1}{4}$  inch in diameter. It appears that there is more danger of this in a lead schedule than in a methoxychlor schedule. Fruit color may be lighter with actidione than with other standard cherry fungicides. Not enough information is available on concentrating actidione to recommend this practice.

Several growers have reported satisfactory performance at rates up to 5X. Actidione is inactivated by lime and other alkaline materials. Nu-Iron at 1/2 lb. or ferbam at 1/2 lb. per 100 gallons might be suggested in the place of lime as a corrective for lead arsenate. Nu-Iron treated cherries were darker in color than other treatments in test conducted from 1955-1959.

For the grower who uses a dusting schedule, a 90-10 sulfur-lead-arsenate mixture is indicated. If *curculio* is abundant, an 80-20 mixture of the same materials may be used.

### **Shuck spray for sour cherries**

*(When the shucks are falling from the fruits that are going to set)*

The same suggestions and materials as those mentioned under petal-fall spray apply to the shuck spray.

This spray is effective against *curculio*, leaf spot, and brown rot.

For dust, an 80-20 sulfur-lead-arsenate mixture is indicated.

### **Later sprays for sour cherries**

These later sprays are for cherry, fruit flies, leaf spot, and brown rot.

### **First fruit-fly spray for sour cherries**

*(A week after the fruit flies have first appeared or about the time Early Richmond first shows a tinge of color)*

The materials and suggestions are the same as those given under the petal-fall spray (page 27).

Diazinon, at the rate of 2 pounds of the 25 per cent wettable powder, may be substituted for lead arsenate in all three fruit fly sprays. Diazinon, because of limited grower experience, is recommended for use on a trial basis only.

### **Second fruit-fly spray for sour cherries**

*(About 10 days later than the first fruit-fly spray or when Montmorency begins to color)*

The materials and suggestions are the same as those mentioned under the petal-fall spray (page 27).

For dust, a 90-10 sulfur-lead-arsenate mixture is indicated. The applications are made at the same times as indicated for sprays; but, if there are heavy rains, extra dust applications should follow them.

### **Third fruit-fly spray for sour cherries**

In most years, a third application is needed 10 days after the second for fruit-fly protection using the same formula as the petal-fall spray.

### **After-picking spray**

*(Soon after harvest)*

The choice of fungicides given under the petal-fall spray (page 27) applies for this application. The insecticide should be omitted.

Additional fungicides which may be used after the crop is harvested are 1 1/2-6-100 Bordeaux mixture or actidione at 2 parts per million.

The following miticides may be used in the post-harvest spray if mites are a problem: Ovex, at the rate of 1 pound of 50 per cent wettable powder; parathion, at 1 pound of 15 per cent wettable powder; malathion, at 2 pounds of 25 per cent wettable powder; and diazinon, at 1 pound of the 25 per cent wettable powder.

### **For all cherries to be used as fresh fruit**

Any of the insecticides mentioned for petal-fall spray may be used up to the first fruit-spray. To insure that the residue will be safe when the cherries are to be used as fresh fruit, the fruit-fly sprays should be changed to one of the following formulas.

Fine ground derris or cubé powder .....	2 pounds
(containing from 4 to 5 per cent of rotenone)	
Wettable sulfur at manufacturer's directions	
or	
Methoxychlor .....	3 pounds
Any fungicide listed under petal-fall spray.....	as indicated

### **For Sweet Cherries**

#### **Dormant spray for sweet cherries**

*(Before the buds are open)*

The DNC sprays are effective for the control of **black cherry aphid** at the rate of 1½ quarts of a liquid or 1½ pounds of powdered DNC (Elgetol, Krenite, and the like) material in 100 gallons of water.

The newer DNBP materials (DN-289, Elgetol 318) may also be used at the rate of 1 quart in 100 gallons of spray.

#### **Pre-blossom spray for sweet cherries**

*(Just before the blossoms open)*

Elemental-sulfur paste .....	10 pounds
Oil type of sticker .....	1 pint
or	
Captan .....	2 pounds
plus	
Water to make .....	100 gallons

For control of **brown-rot blossom blight**, additional applications in bloom may be needed. Phygon at ½ pound plus half the usual amount of sulfur has given excellent control of brown rot blossom blight of peaches in Pennsylvania and would seem preferable for trial on sweet cherries. Captan has caused severe leaf injury on Schmidt and Emperor Francis varieties of sweet cherries in late sprays.



### **Petal-fall spray for sweet cherries**

(for *leaf spot, brown rot, and plum curculio*)

Elemental-sulfur paste .....	10 pounds
Oil type of sticker .....	1 pint
or	
Elemental sulfur (actual sulfur) .....	5 pounds
or	
Captan .....	2 pounds
or	
*Elemental sulfur (actual sulfur) .....	3 pounds
Ferbam .....	1 pound
plus	
Choice of insecticides listed under petal-fall spray for sour cherries.	
plus	
Water to make .....	100 gallons

\*The sulfur-ferbam mixture gives control of *brown rot, botrytis rot, and leaf spot*. If cool, wet weather prevails in bloom the use of the mixture may be started in bloom.

The addition of  $\frac{1}{2}$  pound of soybean flour improves the spreading qualities of the lime-sulfur-lead-arsenate mixture.

*Copper sprays are unsafe for use on sweet cherries.* The  $1\frac{1}{2}$  pint dosage of glyodin used on sour cherries has not been tested on sweet varieties. Ferbam gives satisfactory control of *leaf spot* but may fail to keep *brown rot* in check if used alone. Ferbam and sulfur sprays should be alternated or a mixture of 3 pounds sulfur and 1 pound of ferbam used to give combined control of *leaf spot, brown rot, and botrytis rot*.

### **Shuck spray for sweet cherries**

(When the shucks are falling from the fruits which are going to set)

The materials are the same as those outlined for the petal-fall spray.

The shuck spray is effective against *leaf spot, brown rot, and curculio*.

### **Later sprays**

(For *cherry fruit flies, leaf spot, and brown rot*)

During the past few years the black cherry aphid has frequently required summer control measures. Any one of the following sprays may be used:

TEPP .....	$\frac{1}{4}$ to $\frac{1}{2}$ pint
or	
Parathion .....	1 pound
or	
Malathion .....	1 pound
plus	
Water to make .....	100 gallons

### **For sweet cherries to be used as fresh fruit**

It is impossible to recommend a spray schedule that always gives satisfactory maggot control and at the same time insures freedom from spray residue. The following suggestions are offered:

### First fruit-fly spray for sweet cherries

(A week after the fruit flies first appear or about the time Early Richmond shows a tinge of color)

Fine ground derris or cubé powder ..... 2 pounds  
(containing from 4 to 5 per cent of rotenone)  
Fungicides as in petal fall spray  
Water to make ..... 100 gallons

Lime or bordeaux mixture, should not be used with derris or cubé powder.

### Second fruit-fly spray for sweet cherries

(About one week after the first fruit-fly spray)

The formula is the same as that for the first fruit-fly spray.

### Third fruit-fly spray for sweet cherries

(About one week after the second fruit-fly spray)

The formula is the same as that for the first fruit-fly spray.

For those growers who prefer to make only two fruit-fly sprays, it is advisable to use 3 pounds of derris or cubé powder to 100 gallons of spray instead of 2 pounds. Two applications may not give so satisfactory control as three, particularly if there are rainy periods. Methoxychlor or parathion may be substituted for the derris on a trial basis if desired (page 27).

### Pre-harvest spray

Ferbam ..... 1 pound  
(red or black varieties)  
plus  
SEC oil ..... 1/2 pint

### For processed sweet cherries that are to be washed

The schedule is the same as that outlined for sour cherries that are to be washed. *Coppers are unsafe for sweet cherries.*

### After-picking spray for sweet cherries

The schedule is the same as that outlined for sour cherries (page 28) except that sulfurs rather than coppers are used for sweet cherries.

## PEACH

In New York the peach suffers severely from leaf-curl, brown rot, and scab and, in certain localities, from the ravages of the plum curculio. The oriental fruit moth and peach tree borers have been major pests of peach and require suitable control measures. Tarnished plant bug, European fruit lecanium, and cottony peach scale are also important in some areas.

## SPRAY OUTLINE

### Leaf-curl spray

*(After the leaves drop in the fall or in the spring before the buds swell)*

Ferbam .....	1½ pounds
or	
DNC paste .....	½ gallon
or	
DNC dry wettable .....	2 pounds
Water to make .....	100 gallons

\* (If San Jose scale is present, 11 gallons of lime-sulfur should be used. 6½ gallons will also control leaf curl.

Bordeaux mixture may be used at 10-10-100 in the fall or 6-6-100 in the spring. Injury to peach buds has been reported from a late spring spray of 1 gallon of paste DNC (Elgetol).

*The DNBP materials (DN-289 and Elgetol 318) are not safe on peaches.*

### Pre-blossom spray

*(When the blossoms show pink or a little earlier if a rain period threatens)*

Elemental sulfur at manufacturers' directions	
or	
Captan .....	2 pounds
or	
Thylate .....	2 pounds
or	
Phygon .....	½ pound
plus	
Water to make .....	100 gallons

This application is made to prevent **brown-rot blossom blight**.

Additional applications may be needed in bloom or at petal-fall stage. The danger of reducing fruit set by sulfur in bloom should be balanced against the danger of brown rot. Greenhouse tests indicate Phygon is effective up to 12 hours after the beginning of the rain. Phygon at ½ pound plus half the usual amount of sulfur has given excellent control of brown rot blossom blight of peaches in Pennsylvania and would seem preferable for trial. Captan has caused some leaf injury to peaches in later sprays. If **peach mildew** is a problem sulfur should be used.

If a dust schedule is followed, dusting sulfur is recommended.

Where **tarnished plant bugs** (which "cat-face" the fruit) are a severe problem, 2 pounds of DDT (50 per cent wettable powder) should be included. DDT should *not* be applied during bloom.

### Summer Sprays

The basic schedule involves the use of the phosphate materials, guthion, parathion, or malathion plus fungicide. It is designed to control all of the major pests of peach and a number of minor pests with the exception of the Japanese beetle. The number of sprays given here have been carefully determined by

experimental workers at the Geneva station and represent the minimum number of sprays for a complete peach insect- and disease-control schedule. Home orchardists are advised against the use of parathion or guthion, and should use the safer malathion program.

The following formula should be used in all sprays

Elemental sulfur .....	5 pounds
or	
Captan .....	2 pounds
or	
Ziram .....	1 pound
and either	
Parathion .....	2 pounds
or	
Malathion .....	2 pounds
or	
Guthion .....	1 pound
plus	
Water to make .....	100 gallons

### First curculio or shuck split spray

*(When the first shucks are starting to split from the fruits that are going to set)*  
**Peach scab** is controlled by sulfur in the shuck spray and 3 weeks later.

This spray is important for the control of **brown rot** and **plum curculio**. It also gives partial control of **tarnished plant bugs** where a problem.

The influence of temperature on effective control of the plum curculio is of great importance. Adults are active beginning at shuck split and for a period of 3 to 5 weeks thereafter, depending on area and the number of warm temperature periods. When temperatures of 70° to 75° F. are reached on 2 to 3 successive days, curculio adults become active. If such temperatures are reached just prior to shuck split, then injury can be expected immediately after the fruits are exposed. In such an instance the wise grower is early with his insecticide rather than late. If there is a week of hot weather after shuck split, a 7-day interval is advised, especially where parathion is used. Guthion has somewhat longer residual action than parathion and a longer interval appears to be permissible.

Dieldrin may be used in the curculio sprays at the rate of 1/2 pound of the 50 per cent powder. It does not protect against the oriental fruit moth and borers and the over-all program is materially weakened. Its use is therefore not recommended as a general practice.

### Second curculio spray

*(From 7 to 10 days after shuck-split spray)*

The second spray is important for **plum curculio** and **brown rot** as well as for **first-brood oriental fruit moth** and the **lesser peach tree borer**. Spray the trunks and scaffold limbs as well as the fruit and foliage.

### Third curculio spray

*(From 7 to 10 days after second curculio spray)*

A third spray is necessary in eastern New York to continue protection against

the **plum curculio**. It is also of value against **brown rot**, **oriental fruit moth**, and **lesser peach tree borer**.

#### **First fruit-moth spray**

*(From July 7 to July 15)*

This first fruit-moth spray provides protection against **oriental fruit moth**, **peach tree borers**, **cottony peach scale**, **European fruit lecanium scale**, and **brown rot**. The spray is applied to trunks and scaffold limbs as well as to the foliage and fruit for maximum results, and is directed to the undersides of the leaves where scale insects are a problem.

Where **cottony peach scale** or **lecanium scale** is a problem, it may be necessary to adjust time of application for maximum control. Parathion or guthion is effective for a period from about 10 days after the beginning of the summer hatch of the crawlers of either scale until completion of the hatch. Where both scales are a problem, a spray at the completion of the cottony peach scale hatch will normally give protection against both species. Malathion is of little value against scale insects.

#### **Second fruit-moth spray**

*(From August 1 to August 10)*

The second fruit-moth spray is important for **oriental fruit moth** and **peach tree borers**. Sprays applied at this time should have low enough residues to constitute no problem on varieties such as **Golden Jubilee** and those picked later than **Jubilee**.

#### **Special sprays**

A final treatment of elemental sulfur alone at manufacturers' directions should be made just before harvest.

In 1956 a number of orchards in western New York were afflicted during July and August by the **tarnished plant bug**. No practical schedule has been devised to protect against such attack other than DDT or parathion at approximately 10-day intervals beginning at the onset of bug activity and continuing until activity ceases.

#### **Japanese beetle**

As phosphates lose their toxicity to the **Japanese beetle** within 3 to 5 days, special measures must be taken in areas where the beetle is a problem.

In the southern part of the Hudson Valley where **Japanese-beetle** infestations are heavy, fruit may require protection from mid-July to mid-August. Zinc dimethyldithiocarbamate (ziram), 1½ pounds in 100 gallons of water, is a good repellent to **Japanese beetle** and may be substituted in place of the sulfur. If beetles attack the ripening fruit, make a preharvest rotenone spray or dust or a spray of ziram.

## **PLUM AND PRUNE**

The main troubles for which commercial growers of plums and prunes find spraying necessary are **plum curculio**, **leaf spot**, and **brown rot**. In some plantings, **European red mite**, **European fruit lecanium**, **apple maggot**, and **black knot** may require special attention.

## SPRAY OUTLINE

### Spring Sprays

#### Green-tip spray

(As the buds are breaking)

Bordeaux mixture .....	6-12-100
Water to make .....	100 gallons

If **black knot** is a serious problem, a green-tip spray should be made in addition to the regular shuck and summer sprays on plums and prunes.

If **bud moth** is a problem, 1 pound of 15 per cent parathion should be included in the bordeaux formula above.

#### Pre-blossom spray

(Just before the blossoms open)

Elemental-sulfur paste .....	10 pounds
Oil type sticker .....	1 pint
or	
Captan .....	2 pounds
or	
Phygon .....	1/2 pound
plus	
Water to make .....	100 gallons

This pre-blossom spray controls **brown-rot blossom-blight**. Additional applications in bloom may be needed. The danger of reducing fruit set by sulfur in bloom should be balanced against the danger of brown rot.

#### First curculio spray

(When the shucks first start to split)

Elemental sulfur at manufacturers' directions	
or	
Captan .....	2 pounds
or	
Bordeaux plus summer oil .....	2-5-100
plus	
Parathion .....	2 pounds
or	
Guthion .....	1 pound
or	
Methoxychlor .....	3 pounds
plus	
Water to make .....	100 gallons

The spray programs are effective in controlling **plum curculio**, **leaf spot**, and **brown rot**. The remarks regarding temperatures given under the first curculio spray on peaches (page 33) also apply here. In orchards where curculio is a severe problem, dieldrin at the rate of 1/2 pound per 100 gallons may be substituted for the above listed insecticides on a trial basis. Parathion and guthion will also control **red mites**. The fungicide should be repeated 2-3 weeks later for control of **leaf spot** and **brown rot**.

### Second curculio spray

(From 7 to 10 days after the first curculio spray)

The same choice of materials may be made as in the first curculio spray.

### Third curculio spray

(From 7 to 10 days after the second curculio spray)

A third spray is necessary in eastern New York to control **plum curculio**.

In seasons of extended activity of plum curculio, the third curculio spray may be needed in western New York and a fourth spray may be necessary in eastern New York, using the same materials and timing. The local county agent or Spray Information Service letter gives the details.

Where **lecanium scale** is a problem, a spray using the parathion or Guthion should be applied from 16 to 20 days after the second curculio spray. In other words, at the completion of scale hatch. The undersides of the leaves must be thoroughly covered.

### Later Sprays

(Two or three weeks before the fruit ripens)

Fungicide listed under petal fall spray

Water to make ..... 100 gallons

The applications control **brown rot** and **leaf spot**.

For a dust schedule, applications of dusting sulfur are indicated.

In some orchards, the **red-banded leaf roller** builds up in sufficient numbers to require control measures. Where parathion or Guthion is used in the curculio spray, the first brood will be adequately controlled. Where methoxychlor or dieldrin is used, 1 pound of 50 per cent DDD powder should be added in the second curculio spray. For second brood control, DDD is used at the rate of 2 pounds of powder during the first week in August. Where DDT is being used for apple maggot control, the DDD may be substituted for DDT. Parathion at the rate of 1½ pounds of the 15 per cent powder is another effective material for the control of **leaf roller** and also for **mites** and **bud moth**.

### European red mite and two-spotted mite control

(Two applications spaced 7 to 10 days apart are necessary)

Parathion .....	1 pound
or	
Kelthane* .....	1½ pounds
or	
Ovex* .....	1 pound
or	
Malathion .....	2 pounds
plus	
Water to make .....	100 gallons

\*Use where resistance to phosphates has developed. Superior oil, 2 gallons, or Genite EM923 at the rate of 1½ pints, can be used in the dormant or delayed dormant spray where resistance is a problem.



In some orchards, the **apple maggot** causes considerable damage to prunes. In orchards not surrounded or bordered by unsprayed trees, the maggot may be controlled with three to four applications of DDT. Applications of DDT, 2 pounds of 50 per cent wettable powder in 100 gallons of water, should be started about June 20 in eastern New York and about July 1 in western New York and applied at 10-day intervals.

## QUINCE

Fortunately, the quince is subject to attack by only a comparatively small number of insects and diseases. In the past the most serious insect enemy has been the **quince curculio**, but the **oriental fruit moth** is now much more destructive. The **red-banded leaf roller** has also caused considerable losses in recent years. Among diseases subject to control by spraying, the most important is **leaf-blight** and **fruit spot**; occasionally the **Brooks fruit spot** may cause serious losses.

### SPRAYING OUTLINE

#### Spring Sprays

##### Dormant spray

*(In the spring before the buds start)*

Dormant-type oil emulsion, diluted to contain 3 per cent of oil.

Apply this when **lecanium scale** becomes abundant, or for **European red mite**. Summer measures as discussed under peaches and prunes may be used if this spray is omitted.

##### Pink spray

*(When the blossoms show pink)*

Lime-sulfur .....	2½ gallons
Water to make .....	100 gallons
or	
3-8-100 bordeaux mixture	
or	
Ferbam .....	1½ pounds
or	
Elemental sulfur (actual sulfur) .....	5 pounds

The lime-sulfur gives good control but often causes considerable spray injury. Bordeaux mixture gives excellent control of **leaf-blight** and **fruit spot** but fruit and leaf injury may be severe. Ferbam gives good disease control and sulfur gives fair control. Neither causes spray injury at this time.

### Petal-fall spray

(When 90 per cent of the petals have started to wither)

Bordeaux mixture .....	3-8-100
or	
Ferbam .....	1½ pounds
or	
Elemental sulfur (actual sulfur) .....	5 pounds
with	
DDT .....	2 pounds
Water to make .....	100 gallons

This spray controls leaf-blight, leaf spot, codling moth, and oriental fruit moth.

If **plum curculio** is a problem, 2 pounds of lead arsenate may be added to the formula.

Lime-sulfur should not be used with DDT. When lead arsenate and lime-sulfur are used, 1 pound of lime is added for each pound of lead arsenate.

### Later Sprays

The same formula as suggested in the petal-fall spray is advised except that sulfur is not suggested after the petal-fall spray.

The first application is made 10 days after the petal-fall spray. This spray controls leaf spot, leaf-blight, and oriental fruit moth. If **quince curculio** is a problem, 3 pounds of lead arsenate is added to the formula.

Two applications after the petal-fall spray are usually enough to control leaf spot, leaf-blight, and **quince curculio**.

For the control of **oriental fruit moth** with DDT, from three to four more applications should follow the 10-day spray at 19- to 21-day intervals.

DDD (TDE) may be used in place of DDT during the first two weeks in August at the rate of 2 pounds of 50 per cent powder in 100 gallons of spray to control **red-banded leaf roller**. The DDD should provide enough protection against **oriental fruit moth** without the addition of DDT.



## SAFETY WITH INSECTICIDES

The organic phosphate materials, TEPP, parathion, phosdrin, guthion, trithion, and demeton (Systox), are highly poisonous to man if improperly used. The following precautions should be followed when using these materials. Endrin, although not a phosphate, is also hazardous to use. In addition, all chemical poisons should be treated with respect.

1. The greatest danger from parathion or other wettable powders appears to be in the operation of putting the wettable powder from the bag or can into the spray tank. Be careful at this point.
2. Wear a respirator with a filter for powders and an activated charcoal filter for organic vapors. Check charcoal filter to be sure it is labeled for the phosphate you are using and change after the number of hours specified. Phosdrin requires a special respirator.
3. Wear natural rubber gloves.
4. Protect the body from wettable powder and from spray drift. Wear rubber or plastic coats or wash your clothes every day.
5. Symptoms of poisoning: headache, nausea, pin-point vision, constriction of the chest.
6. If the above symptoms are experienced, do not delay—see your doctor. The antidote is atropine sulphate and cannot be obtained without a doctor's prescription. It is wise to have atropine sulphate on hand. If symptoms are experienced, see your doctor and follow his recommendations for using the atropine sulphate. An overdose can be **poisonous**.
7. Never thin and remove suckers until several days after phosphate applications. Handling insecticides safely is similar to driving an automobile or handling fire. If certain precautions are followed, these useful instruments and materials can be used to advantage. If misused, they can do serious harm.

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